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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. |
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09/234,233 01/20/99 LI

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| EXAMINER |
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VU.D

| ART UNIT | PAPER NUMBER |
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2818

DATE MAILED:

01/04/01

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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/234,233

Applicant(s)

LI ET AL.

Examiner

DAVID VU

Art Unit

2818

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

- 1) ☒ Responsive to communication(s) filed on 10/24/00.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some * c) ☐ None of the CERTIFIED copies of the priority documents have been:
1. ☐ received.
2. ☐ received in Application No. (Series Code / Serial Number) _____.
3. ☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 18) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

1. Claims 10-21 are rejected under 35 U.S.C. 102(b) as being unpatentable over O. Joubert, T.W. Weidman, A.M. Joshi, R.L. Kostelak (Micro Electronic Engineering 30, 1996, Pages 275-278).

O. Joubert, T.W. Weidman, A.M. Joshi, R.L. Kostelak (Micro Electronic Engineering 30, 1996, Pages 275-278) disclose a semiconductor processing method, comprising:

Plasma polymerised methylsilane (PPMS) resist film were deposited over a semiconductive wafer substrate;

exposing some portions of the layer to energy while leaving other portions unexposed, the exposing altering physical properties of the exposed portions of material relative to the unexposed portions of material; (Fig. 1-2, Page 276)

after the exposing, subjecting the exposed and unexposed portions of the layer to common conditions, the common conditions being effective to remove the PPMS and

comprising a rate of removal that is influenced by the altered physical properties of the layer, the common conditions removing either the exposed or unexposed portions faster than the other of the exposed and unexposed portions; (See section 3.3, page.277-278 and Introduction, Page. 275).

Regarding claims 11-14, O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) disclose the material is PPMS (chemical structure of PPMS on page 276) wherein the material comprises carbon, silicon and oxygen,silicon bound to a hydrocarbon group and bound to oxygen and wherein the hydrocarbon group does not comprise a carbon containing ring.

Regarding claims 16 and 18, O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) disclose the energy is in the form of ultraviolet light and the energy is in the form of a plasma (See Section 2. Experimental, page 275)

2. Claims 25-28 and 33 are rejected under 35 U.S.C. 102(e) as being unpatentable over Hayase et al.,(US 5,962,581).

Hayase et al., (Col. 37, Lines. 24-46) disclose a semiconductor processing method, comprising:

forming a layer of silanolic hydroxyl group (Si-OH) over a substrate;
exposing some portions of the layer to light while leaving other portions unexposed, the exposing converting the exposed portions to siloxane bond (Si-O-Si);

and through a development with an organic solvent , such as an aqueous hydrofluoric acid (Col. 36, Lines. 47-55 and Col. 37, Lines. 12-18), the non exposure portion can be selectively removed whereby forming a negative type pattern.

after the exposing, subjecting the exposed and unexposed portions of the layer to hydrofluoric acid to selectively remove the Si(OH)_4 of the unexposed portions relative to the SiO_2 of the exposed portions.

Regarding claims 26 and 28, Hayase et al., (Col. 7, Lines. 35-47) disclose the energy is in the form of light, electron beam or X-ray.

Regarding claim 27, Hayase et al., (Col. 37, Lines. 24-46 and Fig. 1C) disclose the energy is in the form of ultraviolet light and is passed onto the layer of Si(OH)_4 through openings in a patterned mask.

Regarding claim 33, Hayase et al., (Col. 37, Lines. 24-46) disclose forming the layer silanolic hydroxyl group (Si-OH) on a substrate.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-9 and 30-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278).

O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) disclose a semiconductor processing method, comprising:

Plasma polymerised methylsilane (PPMS) resist film were deposited over a semiconductive wafer substrate;

exposing some portions of the layer to energy while leaving other portions unexposed, the exposing altering physical properties of the exposed portions of material relative to the unexposed portions of material; (Fig.1-2, Page 276)

after the exposing, subjecting the exposed and unexposed portions of the layer to common conditions, the common conditions being effective to remove the PPMS and comprising a rate of removal that is influenced by the altered physical properties of the layer, the common conditions removing either the exposed or unexposed portions faster than the other of the exposed and unexposed portions; (See section 3.3, page.277-278 and Introduction, Page. 275).

O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) disclose all claimed subject matter, but fail to teach cutting the wafer into separated die. However, one of ordinary skill in the art

Art Unit: 2818

would have found it obvious to dice the wafer in order to form the individual packing after step of forming the multidevice/transistor on the same wafer.

Regarding claims 2-5, O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) disclose the material is PPMS (chemical structure of PPMS on page 276) wherein the material comprises carbon, silicon and oxygen, silicon bound to a hydrocarbon group and bound to oxygen.

Regarding claims 7 and 9, O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) disclose the energy is in the form of ultraviolet light and the energy is in the form of a plasma (See Section 2. Experimental, page 275)

Regarding claims 30 and 31, O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) disclose the forming a PPMS layer comprises depositing a PPMS as deposited. (See Introduction, page 275)

4. Claims 6, 15 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) in view of Hayase et al.(US 5,962,581)

O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) disclose all claimed subject matter, but fail to teach the material comprises $\text{Si}(\text{OH})_4$.

Hayase et al., disclose the material comprises $\text{Si}(\text{OH})_4$ (Col.7. Lines. 35-47)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a material such as silanol for a resist film, since it has been held within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

5. Claims 8 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) in view of Hayase et al.(US 5,962,581)

O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) disclose all claimed subject matter, but fail to teach the energy is in the form of an electron beam.

Hayase et al., (Col. 7, Lines. 35-47) disclose the energy is in the form of light, electron beam or X-ray. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the energy in form of an electron beam, since it has been held within the general skill of a worker in the art to select a known source of radiation on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

6. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) in view of Hayase et al.,(US 5,962,581).

O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) disclose all claimed subject matter, but fail to teach the layer of organosilanol is subjected to hydrofluoric acid to selectively remove organolisanol of the unexposed portions.

O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) shows a semiconductor processing method, comprising:

forming a layer of PPMS over a substrate;

exposing some portions of the layer to ultraviolet light while leaving other portions unexposed, the exposing converting the exposed portions to PPMSO. The resulting patterns can be developed to provide either negative tone or positive tone patterns.

However, Hayase et al., (Col. 36, Lines. 47-55 and Col. 37, Lines. 12-18) disclose subjecting the exposed and unexposed portions of the layer to hydrofluoric acid to selectively remove the organosilanol of the unexposed portions relative to the organosilicon oxide of the exposed portions. One of ordinary skill in the art would have readily recognized the advantage and desirability to combine Joubert ,Olivier (EP 0942330 A1) by using Hayase et al., (Col. 36, Lines. 47-55 and Col. 37, Lines. 12-18) in

order to obtain the negative type pattern. Organic solvents useful in this case is an aqueous hydrofluoric acid solution which is less harmful to environment can be employed.

7. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) in view of Hayase et al.(US 5,962,581)

O.Joubert, T.W. Weidman, A.M.Joshi, R.L. Kostelak (Micro Electronic Engineering 30 ,1996, Pages 275-278) disclose all claimed subject matter, but fail to teach the material comprises $\text{Si}(\text{OH})_4$.

Hayase et al., (Col. 7, Lines. 35-47) disclose the silicon-comprising material comprises $\text{Si}(\text{OH})_4$ and the energy is in the form of ultraviolet light, electron beam or X-ray, the exposing comprises passing the ultraviolet light through openings in a patterned mask and onto the layer of material to expose some portions of the layer to the ultraviolet light while leaving other portions unexposed (Fig. 1A-1C) and the common conditions comprising subjecting the entire layer to a solvent comprising hydrofluoric acid, the hydrofluoric acid removing portions of the layer that were not exposed to ultraviolet light at a faster rate than portions of the layer that were exposed to ultraviolet light, electron beam or X-ray. (Col. 36, Lines. 47-55 and Col. 37, Lines. 12-18). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a material such as silanol for a resist film, since it has been held within the general skill of a worker in the art to select a known material on the basis of its suitability

Art Unit: 2818

for the intended used as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

8. Claims 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Joubert ,Olivier (EP 0942330 A1) in view of Hayase et al.,(US 5,962,581).

Joubert ,Olivier (EP 0942330 A1) discloses all claimed subject matter, but fail to teach the layer of organosilanol is subjected to hydrofluoric acid to selectively remove organolisanol of the unexposed portions.

Joubert ,Olivier (EP 0942330 A1) (Col. 2, Lines. 6-17) shows a semiconductor processing method, comprising:

forming a layer of PPMS over a substrate;

exposing some portions of the layer to ultraviolet light while leaving other portions unexposed, the exposing converting the exposed portions to PPMSO. The resulting patterns can be developed to provide either negative tone or positive tone patterns.

However, Hayase et al., (Col. 36, Lines. 47-55 and Col. 37, Lines. 12-18) disclose subjecting the exposed and unexposed portions of the layer to hydrofluoric acid to selectively remove the organosilanol of the unexposed portions relative to the organosilicon oxide of the exposed portions. One of ordinary skill in the art would have readily recognized the advantage and desirability to combine Joubert ,Olivier (EP 0942330 A1) by using Hayase et al., (Col. 36, Lines. 47-55 and Col. 37, Lines. 12-18) in order to obtain the negative type pattern. Organic solvents useful in this case is an

Art Unit: 2818

aqueous hydrofluoric acid solution which is less harmful to environment can be employed.

Regarding claim 23, Joubert ,Olivier shows the ultraviolet light is passed onto the layer of PPMS through openings in a patterned mask. (Col.5, Lines. 25-29 and Fig. 2A)

Regarding claim 24, neither Joubert ,Olivier nor Hayase et al., described die cutting. However, one of ordinary skill in the art would have found it obvious to dice the wafer in order to form the individual packing after step of forming the multidevice/transistor on the same wafer.

9. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hayase et al.,(US 5,962,581).

Hayase et al., disclose all claimed subject matter, but fail to teach cutting the wafer into separated die. However, one of ordinary skill in the art would have found it obvious to dice the wafer in order to form the individual packing after step of forming the multidevice/transistor on the same wafer.


Art Unit: 2818

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David Vu whose telephone number is (703) 305-0391. The examiner can normally be reached on Monday-Friday from 8:00am to 5:00pm. If attempt to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms., can be reached on (703) 308-4910.

David Vu

Art Unit 2818


David Nelms
Supervisory Patent Examiner
Technology Center 2800